



PUBLIC ADDRESS AMPLIFIERS

MODELS CT60B and CT100B

The Bogen Models CT60B and CT100B are uniquely versatile amplifiers, designed for professional-quality sound systems that previously required custom assemblies. The CT60B, rated at 60 watts, and the CT100B, rated at 100 watts output, are comprised of integrated circuits, silicon transistors and diodes with the latest state-of-the-art active 2/3 octave equalization circuitry. Both models are UL and CSA listed.

Four low-impedance, transformer isolated, balanced microphone inputs, (expandable to six with an accessory PMM-2B) each with individual volume controls, are convertible to high-impedance inputs by rearranging jumpers on the printed circuit board. A phantom supply for the use of condenser microphones is built into these units. Professional three-pin female, XLR-type microphone connectors are provided on the rear panel.

Two auxiliary channels, with an AUX1/AUX2 fader control can be used for inputs from a tuner, tape/cassette player, phonograph with a ceramic cartridge, or an optional TG-4B Multiple Tone Generator.

Built-in microphone precedence, remote volume control, 500/600-ohm line input and output, with accessories, tape and tape/booster outputs, amplifier bridging, and connecting amplifiers' outputs in series are among the many capabilities of these units.

Ten slide controls, with detented flat positions, allow the selected frequency equalizer filter circuit to meet individual installation requirements. Feedback is virtually eliminated, while intelligibility is greatly improved, and usable power is increased.

A recessed screwdriver-adjustable front panel control for an electronic compressor circuit is also provided. This circuit compensates for poor microphone technique or a variety of announcers, and it eliminates "blasting" in background music applications.

Screw terminals on the rear panel allow connections to standard speaker impedance taps, as well as connections for 25-volt and 70-volt balanced lines.

The amplifier operates from a 105-125 volt, 60 Hz source. A three-prong line cord provides automatic grounding when connected to a three-wire grounded power outlet. The power line is protected by a circuit breaker, and the output transistors by a thermal overload device, which shuts off the unit when the temperature of the heat sink rises excessively.

INSTALLATION

UNPACKING

The amplifier was carefully checked before leaving the factory. Inspect shipping container and unit carefully for indications of improper handling. If the unit has been damaged, make an immediate claim to the distributor from whom it was purchased. If the amplifier was shipped to you, notify the carrier without delay and place your claim.

POWER AND GROUNDING

The ac line cord has a three-prong plug which should be plugged into a three-wire grounded, 120 volt, 60 Hz outlet. As it is important to ground the amplifier, where a three-wire outlet is not available, use an adapter (e.g., Leviton No. 5017) and connect the grounding pigtail to the screw securing the wall plate. If the wall plate screw is not grounded, connect a wire from the GND terminal of the amplifier to a suitable ground.

AUXILIARY POWER

CAUTION

Use the ON/OFF switch on a phonograph or other accessory unit connected to the auxiliary receptacle, as the power switch on the amplifier does not control this receptacle.

The auxiliary power receptacle on the rear chassis is a three-wire grounded outlet which can supply power to accessory equipment in the sound system. Be sure that the accessory component does not require more than 300 watts. The power switch does not control this receptacle.

Associated equipment connected to the auxiliary receptacle with a three-prong line cord will be grounded, providing the amplifier line cord has been properly grounded.

CAUTION

The following installation instructions are for use by qualified service personnel only. To avoid an electric shock, do not perform any functions requiring the removal of the cover of the amplifier unless you are qualified to do so.

INPUT CONNECTIONS

LOW-IMPEDANCE BALANCED MICROPHONES: The amplifier is designed for direct connection of low-impedance balanced microphones to the MIC input receptacles of the amplifier. The microphone lead should be a two-conductor shielded cable terminated in a Cannon XLR-312-C or Bogen CON-2 connector, as shown in Figure 1.

CONDENSER MICROPHONES: Connect in the same manner as for low-impedance balanced microphones.

HIGH-IMPEDANCE MICROPHONES: The microphone lead should be a single-conductor shielded cable under 35 feet in length and terminated in a Cannon XLR-312-C or Bogen CON-2 connector, as shown in Figure 1. For information regarding the use of high-impedance microphones, see notes on the schematic diagram.

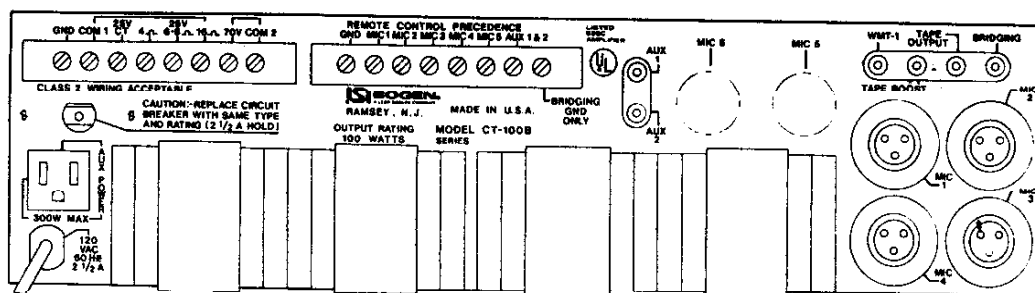


Figure 2 — Rear Panel, CT100B

OUTPUT CONNECTIONS

SPEAKERS: Output connections are available on the rear panel terminal strip for 4 (CT-100B), 8, 16-ohm speakers, 25 volt center-tapped and 70 volt lines. Connections necessary are listed in Table 1. Class 2 wiring may be used.

TAPE OUTPUT: A tape recorder may also be driven from the TAPE OUTPUT jack on the amplifier. In this case, the output is not subject to the master volume and equalization settings of the amplifier and is controlled at the tape recorder. A patch cord terminated in an RCA phono plug is connected between the TAPE OUTPUT jack on the amplifier and the input of the tape recorder.

BOOSTER OUTPUT: The amplifier may be used to drive a booster amplifier. Connect a patch cord with an RCA phono plug from the BOOSTER jack on the rear panel of the amplifier to the high impedance input of the booster amplifier. The output at this jack is controlled by the amplifier's volume and equalization controls.

WMT-1 OUTPUT: This receptacle is used to accommodate a Bogen accessory which provides connections to a 500/600-ohm telephone line. (Refer to Accessories Section).

CONNECTING AMPLIFIERS IN SERIES

Pairs of the *same amplifier models* can be connected in series to effectively double the power output into the same loadline, as well as increase the input capacity. See Figure 3 for connection diagram. Be certain to remove the link between COM and GND of amplifier No. 2.

Tone and master volume controls of both amplifiers should be at the same setting to assure that each amplifier will share the load equally.

Connect a single conductor shielded cable, terminated in an RCA phono plug at each end, between the rear panel BRIDGING receptacles and BRIDGING GND terminal of both amplifiers. This assures that any input will have equal amplification.

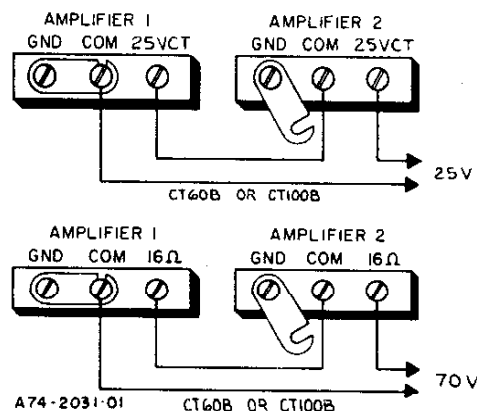


Figure 3 — Connecting Like Amplifiers in Series

TABLE 1 — OUTPUT CONNECTIONS

Models	Speaker Line	Terminal Connections*	Other Connections
CT100B	4Ω Unbalanced	4Ω and COM 1	Close link between COM 1 and GND
	4Ω Balanced	4Ω and COM 1	Open link between COM 1 and GND
Both models	8Ω Unbalanced	8Ω and COM 1	Close link between COM 1 and GND
	8Ω Balanced	8Ω and COM 1	Open link between COM 1 and GND
Both models	16Ω Unbalanced	16Ω and COM 1	Close link between COM 1 and GND
	16Ω Balanced	16Ω and COM 1	Open link between COM 1 and GND
Both models	25V Unbalanced	25V and COM 1	Close link between COM 1 and GND
	25V Balanced	25V and COM 1	Open link between COM 1 and GND
	25V Balanced, CT gnd.	25V and COM 1	Connect jumper between 25V CT and GND
			Open link between COM 1 and GND
Both models	70V Unbalanced	70V and COM 2	Add jumper between COM 2 and GND
	70V Balanced	70V and COM 2	No jumper required

*Also see text under "Output Connections"

ACOUSTIC EQUALIZER: The Acoustic Equalizer permits you to "tune" the amplifier to the room in which the sound system is used, so that the amplifier will operate at a substantially higher output before acoustic feedback occurs. Ten slide controls, located on the front panel, boost or attenuate the output at preferred ISO center frequencies—80, 125, 200, 315, 500, 800, 1250, 2000, 3150 and 5000 Hz—to compensate for varying room acoustics.

Microphone placement may also cause feedback or howling at or near some of these frequencies. If so, feedback can be greatly attenuated by setting the slide control for that particular frequency, as described below.

ACOUSTIC EQUALIZER FILTER ADJUSTMENT

MICROPHONE SOURCE:

The following adjustments of the slide filter controls will permit "tuning" the system so that the output level is substantially higher before acoustic feedback ("squeal" or "ringing") occurs.

1. Set MIC controls and MASTER control to zero (counterclockwise).
2. Set all slide controls to center (flat) position, with speakers connected to the amplifier and microphone(s) in normal operating location(s).
3. Turn the appropriate MIC volume control half-way up, leaving the three other MIC volume controls at zero.
4. Advance MASTER control slowly until feedback ("ringing" or "squeal") is heard.
5. If the feedback sound is high-pitched, one of the five high frequency filter controls—800 Hz to 5 KHz—will be most effective in its elimination. Likewise, a low-end tone will be controlled by a low frequency filter.
6. Individually, move each filter control slowly from the center position to bottom and back to center while listening for change of feedback. The control which eliminates feedback with the least movement should then be moved down only as far as is necessary to eliminate the feedback.
7. Having eliminated the first feedback condition, slowly increase the MASTER control until feedback is heard again. Repeat the procedures of steps 5, 6.
8. If the position of the microphone is changed, or if additional microphones are used, some adjustment to these controls may be necessary.
9. Output level, reduced because of attenuating one frequency, may be partly restored by boosting the adjacent frequency filter control toward maximum.

If feedback is not a problem, the controls should be used to improve the voice quality and intelligibility of the paging system. In most cases, the 80 Hz control should be placed in minimum position while the 2 KHz, 3150 Hz and 5 KHz should be moved toward maximum for improved response. Each system, depending on the speakers used and room acoustics, will require some experimentation with the controls for optimum results.

10. Note and record the settings of the individual filter controls and the MASTER control. These settings are generally applicable to all four MIC input channels. Rubber washers (supplied) can be placed on the slide controls to avoid accidental movement. To do so, pull the slide control knobs off the shafts, insert the rubber washers, and replace the knobs securely. A tinted cover is

shipped with each amplifier and may be used to prevent tampering with the slide controls. Place the cover just under the top of the amplifier and, using the two (2) screws provided, secure it in position.

COMPRESSOR LIMITER: The COMPRESSION control (which is screwdriver-adjustable through the front panel—to avoid tampering) is used to provide relatively uniform output from the amplifier, regardless of variations in the input levels. This is particularly important in speech applications, where a microphone may be used by a number of people with varying voices and microphone techniques. It is also useful for musical programs, particularly when handling background music.

The COMPRESSION control is turned clockwise to reduce the output range for a given variation in input range. Turn the control counterclockwise to increase the output range. To remove compression and restore the normal full range of the amplifier, turn the control fully counterclockwise.

To determine the optimum setting of the COMPRESSION control for speech applications, proceed as indicated below. (For music, the setting will generally be lower than for speech.)

Set the COMPRESSION control fully counterclockwise. Set the MASTER volume control to the highest level likely to be required. Use a level setting that will permit you to pick up clearly spoken inputs in a low voice at a distance of three feet on axis from the microphone. However, do not set the volume level so high as to produce feedback or howling.

Then, speaking in a loud voice directly into the microphone, turn the COMPRESSION control clockwise to the point where the output of the amplifier is reduced to the same level as obtained above. The MASTER control can be used to vary the overall volume without upsetting the COMPRESSION adjustments.

OPERATION

POWER: This switch applies power to the amplifier. It does not control any associated equipment which may be connected to the auxiliary power receptacle on the rear panel. The POWER indicator lamp will go on to show that power has been applied to the unit.

MIC VOLUME: The four individual MIC volume controls are used to adjust the level of each microphone input channel. The control is turned clockwise (to the higher numbers) to increase the volume and counterclockwise to reduce it.

AUX VOLUME: This control serves a two-fold purpose. It selects either of the two auxiliary inputs and it controls the volume of the selected auxiliary input. To select the AUX 1 input, rotate the control counterclockwise past the center position. Turning this control counterclockwise to the higher numbers increases the AUX 1 volume. To select the AUX 2 input, rotate the control clockwise past the center position. Turn the control more clockwise to increase the AUX 2 volume.

If the auxiliary input is not to be used, set the control to the center position. The center position is indicated when the triangle on the control knob coincides with the vertical line between the AUX 1 and AUX 2 designations.

MASTER: This control is used to regulate the overall volume of the amplifier, which may include the mixed output of two or more input channels. To set this control, rotate it to the center position, then set the individual MIC and AUX controls to the highest level likely to be used and consistent with the operation of the limiter compressor. Adjust the MASTER control to the desired listening level for the mixed output.

ACCESSORIES

CAUTION

The installation of internal accessories requires the removal of the cover, which presents an electrical shock hazard. For this reason, these accessories should be installed by qualified service personnel only.

PMM-2B MICROPHONE MODULE: The Bogen PMM-2B Microphone Module is a preamplifier designed to provide two additional microphone channels for the amplifier. Each pre-amplifier channel has its own volume control and will accommodate either low-impedance balanced or high-impedance microphones. These added channels have all the characteristics of the basic channels, and the same accessories are applicable to them, except that provision for remote control, and precedence is made on one of the two additional inputs. The unit is installed and connected as described in the instruction manual furnished with the PMM-2B accessory. Also, see Note 6 in the schematic diagram in this manual.

WMT-1 LINE-MATCHING TRANSFORMER: The Bogen WMT-1 line-matching transformer provides an impedance match between the amplifier and a 0 level, 500/600-ohm line. This may be a telephone line connected to the switchboard for internal paging or used with a wired music system. No soldering is required to connect the WMT-1 to the amplifier.

To connect the input from a balanced 500/600-ohm telephone line, remove the amplifier cover and mount the WMT-1 using the mounting holes provided on the chassis (see Figure 4). Connect the input line to the three-screw terminal board on the WMT-1. Connect the phono plug on the WMT-1 cable to the AUX 1 or AUX 2 jack on the rear of the amplifier. If these jacks are being used for other sound inputs, the WMT-1 may be connected to one of the MIC inputs. In order to do this, the WMT-1 wiring must be modified as described in the instruction sheet supplied with the WMT-1.

To connect the amplifier output to a 500/600-ohm telephone line, remove the amplifier cover and mount the WMT-1 using the mounting holes provided in the chassis (see Figure 4). Connect the 500/600-ohm line to the three-screw terminal board on the WMT-1. Connect the phono plug on the WMT-1 cable to the WMT-1 (OUTPUT) jack (next to the BOOSTER jack) on the rear of the amplifier.

RVC-2B REMOTE VOLUME CONTROL: Connect the RVC-2B to the Remote Control/Precedence terminal (TS101) on the rear of the amplifier. Connect one lead from the accessory to the appropriate MIC or AUX terminal and the other lead to GND. Complete installation instructions are supplied with the RVC-2B accessory.

MODEL TG-4B MULTIPLE TONE GENERATOR: Model TG-4B Multiple Tone Generator is capable of generating four distinct signals: pulsed tone, slow whoop, repeating chime, and steady tone. Each of these four signals may be applied continuously or limited to a double burst (single burst only of the steady tone) for alarm signalling or pre-announcement. Signals are triggered by an external device that provides a contact closure. Both tone level and pitch are adjustable. May be powered from 15-26 VDC source, or use optional Bogen PRS-40 Power Supply for 120 VAC operation.

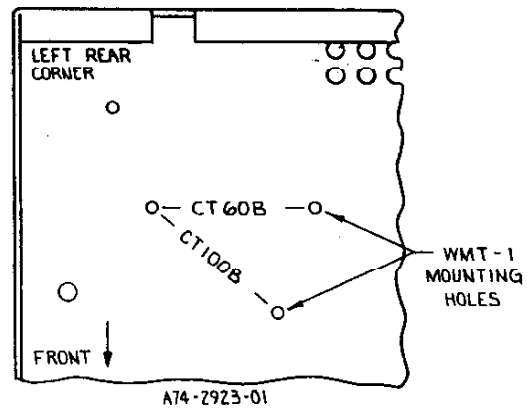


Figure 4 — Mounting Holes for WMT-1

MODEL RPK-51 RACK PANEL KIT: The RPK-51 rack panel is designed to mount the CT-B amplifiers in a standard 19" sound rack.

Before fitting the panel to the amplifier, remove the feet from the base of the amplifier. It is necessary to re-position the cover of the amplifier. To do so, remove four screws from each side of the amplifier; move the cover back approximately 7/8" and align the two holes at the lower edge of the cover with two predrilled holes in the chassis of the amplifier. Position the amplifier into the frame of the rack panel and secure each side by using two screws through the side panel and into the amplifier cover and the chassis. Note that re-positioning the amplifier cover has exposed a screw hole in the side of the amplifier toward the front panel. Drive a screw through the third hole in the panel and into the hole in the side of the amplifier front panel. Repeat this procedure to secure the other side panel to the amplifier, using three screws.

Overall dimensions of the RPK-51 are 5-1/4" H x 19" W with side panels 10-3/4" D (13.3 x 48.3 x 27.3 cm). Cutout dimensions are 4-1/16" H x 16-1/8" W (10.3 x 40.9 cm). The panel is fabricated from cold-rolled steel and has a black finish.

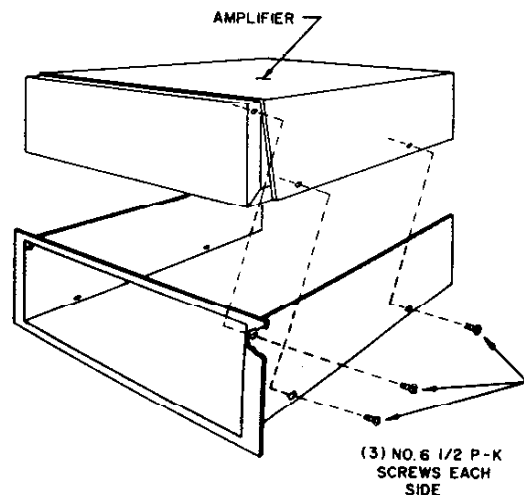


Figure 5—Attaching Rack Panel to Series CT-B Amplifier

CON-2 MICROPHONE CONNECTOR: The Bogen CON-2 is a 3-pin male microphone connector, similar to the Cannon XLR-3-12C or the Switchcraft A3M. The CT60B, CT100B and the PMM-2B microphone connectors are designed to accept mic inputs with these terminations.

TP SERIES TUNERS: The Bogen TP Series solid-state tuners provide FM/AM or FM/AM/FM-Stereo reception of superior signal quality with precise tuning indicators. Output jacks permit connection to an amplifier and/or a tape recorder. A rack-mounting kit (RPK-46) is available for these units.

MAINTENANCE

CAUTION

There are no user-serviceable parts within the amplifier. To avoid an electric shock hazard, have all internal servicing performed by qualified service personnel only.

The warranty will become void if repairs are made by other than the Bogen Service Department or authorized service agency.

CIRCUIT BREAKER

If the circuit breaker opens, the ac power lamp will go out and the amplifier will have no output, but there will be power at the AUX POWER receptacle at the rear panel. Set the ac power switch to off and momentarily depress the red button on the circuit breaker to reset it. Return the ac power switch to on. If the breaker trips again, do not attempt to reset it but have the trouble investigated by a qualified technician.

THERMAL BREAKER

If the thermal breaker opens, there will be no audio output but the ac power lamp will remain on. Wait approximately two minutes for the breaker to reset. If the breaker resets and then opens again, investigate the cause of the temperature overload. This may be due to improper connections at the output terminals or to excessive environmental heat with inadequate ventilation. The thermal breaker will open when the temperature at the output transistor heat sink reaches 105° C (221° F) on all models.

REMOVING PC BOARD FOR SERVICING

To remove the PC board:

1. Remove all knobs and nuts from the front panel controls.
2. Remove four PK screws from the slide control mounting bracket (inside the front panel).
3. Remove two PK screws at either end (toward the front) of the PC board.
4. Disengage the four nylon standoffs that support the rear of the PC board by raising the board gently with one finger while depressing the standoff locking tab with a screwdriver blade or small pliers.
5. Lift the rear portion of the PC board so as to clear the adjacent components and guide it toward the rear of the unit for removal.

REPLACING COMPONENTS

CAUTION

Improper soldering may damage components or the printed circuit board, and such damage can void the warranty.

Many semiconductor components are soldered in place to ensure maximum reliability. When soldering transistors or diodes, use a heat sink (such as a small alligator clip) between the component and the source of heat. Unless you are experienced in the removal of IC micromodules, do not attempt to remove them since excessive heat can damage an IC and/or the printed circuit board. If you are certain that an IC is defective, the easiest method of removal is to cut the leads off close to the component and unsolder the leads individually. If you are not certain an IC is defective, the use of a low-wattage, vacuum-type desoldering tool (such as Ungar Type 7800) is advised.

REPLACING TRANSISTORS

CAUTION

When soldering leads, use a heat sink (such as a small alligator clip) between the transistor and the source of heat.

When replacing the driver transistors, press a small screwdriver blade into the side of the U-clip heat sink to spread the jaws of the clip. Draw the clip and screwdriver off the metal tab on the driver transistor. Reverse the procedure to install the clip on the replacement transistor. Since the U-clip heat sink is a spring clip, avoid spreading the jaws too wide.

When replacing the output transistors, clean all foreign matter from the heat sink, insulator, and transistor. Brush a light coating of silicon compound, such as Dow Corning No. 340, to completely cover both surfaces of the insulator (Part No. 16-9278-01). Place the insulator between the heat sink and the replacement transistor. Use the original transistor mounting hardware to mount the replacement transistor.

BOGEN SERVICE

Our Service Department is interested in the maintenance of your Bogen equipment. If trouble ever develops with your unit, please do not hesitate to ask our advice or assistance. Information can be obtained by writing to Service Department, Bogen, A Lear Siegler Company, P.O. Box 575, Ramsey, NJ 07446.

When communicating with us, give the model number and series designation of your unit. Describe the difficulty encountered and the effects each operating control has upon the symptoms of trouble. Include details on electrical connections to associated equipment, and list such equipment. When we receive this information, we will send you service information if the trouble appears to be simple. If the trouble requires servicing, we shall send you the name and address of the nearest Bogen authorized service agency to which you can send your unit for repairs.

When shipping your unit, pack the amplifier well, using the original shipping carton or a similar container and filler material to prevent damage in transit. Send the unit, fully insured and prepaid, via UPS or any responsible carrier. The unit will be promptly repaired and returned to you collect.

REPLACEMENT PARTS

Most components used in the amplifier are standard parts available through reputable parts suppliers. The parts listed here may be obtained from Bogen distributors, service agencies or directly from the factory. When ordering a part, specify a part number, the model of the unit, and give the series designation, which is a letter followed by numbers, printed on the chassis. For parts on circuit boards, also give the component board assembly number, which begins with "45".

When replacing transistors, use those made by the specified manufacturers. Transistors from other suppliers may not be satisfactory.

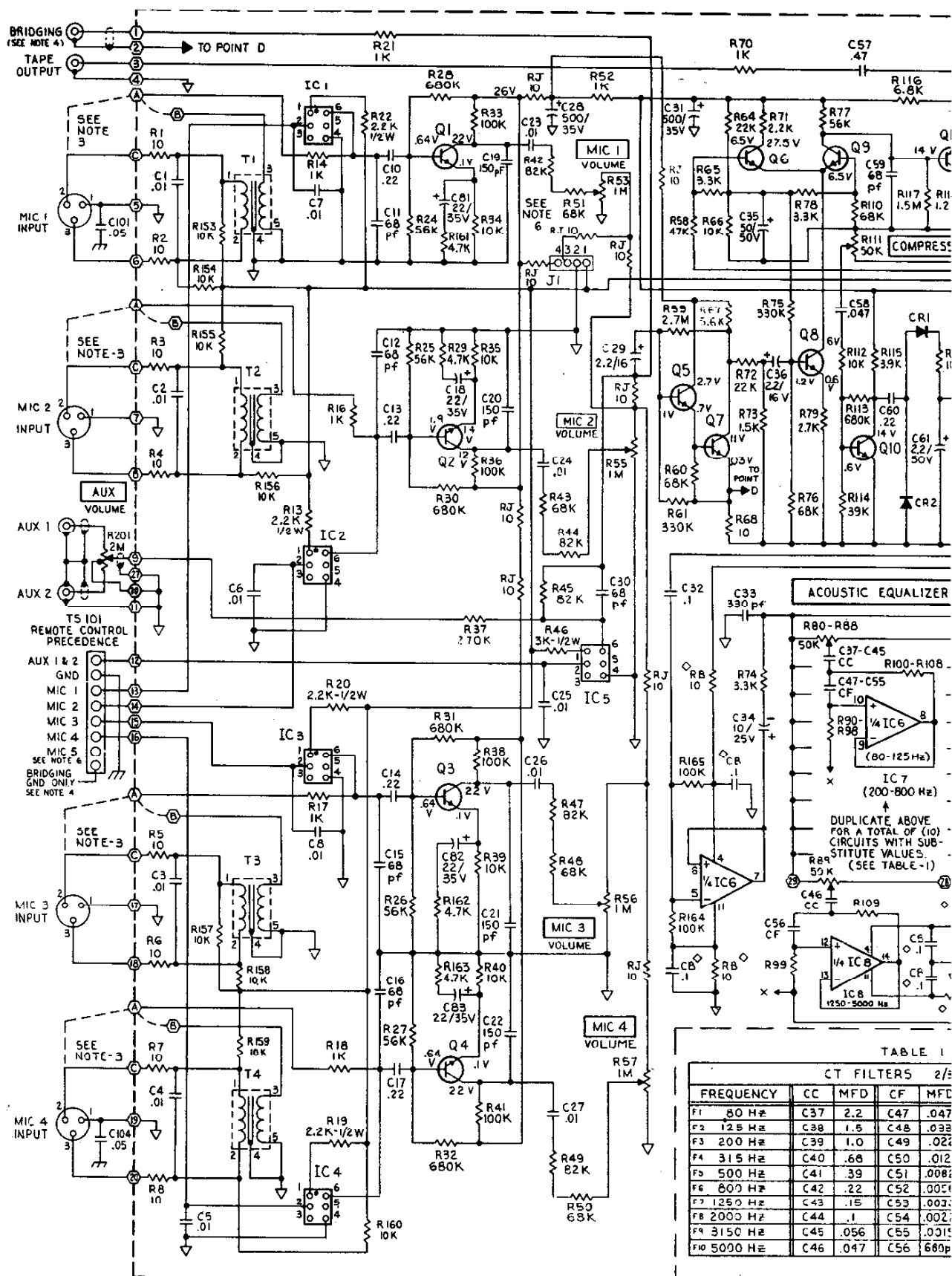
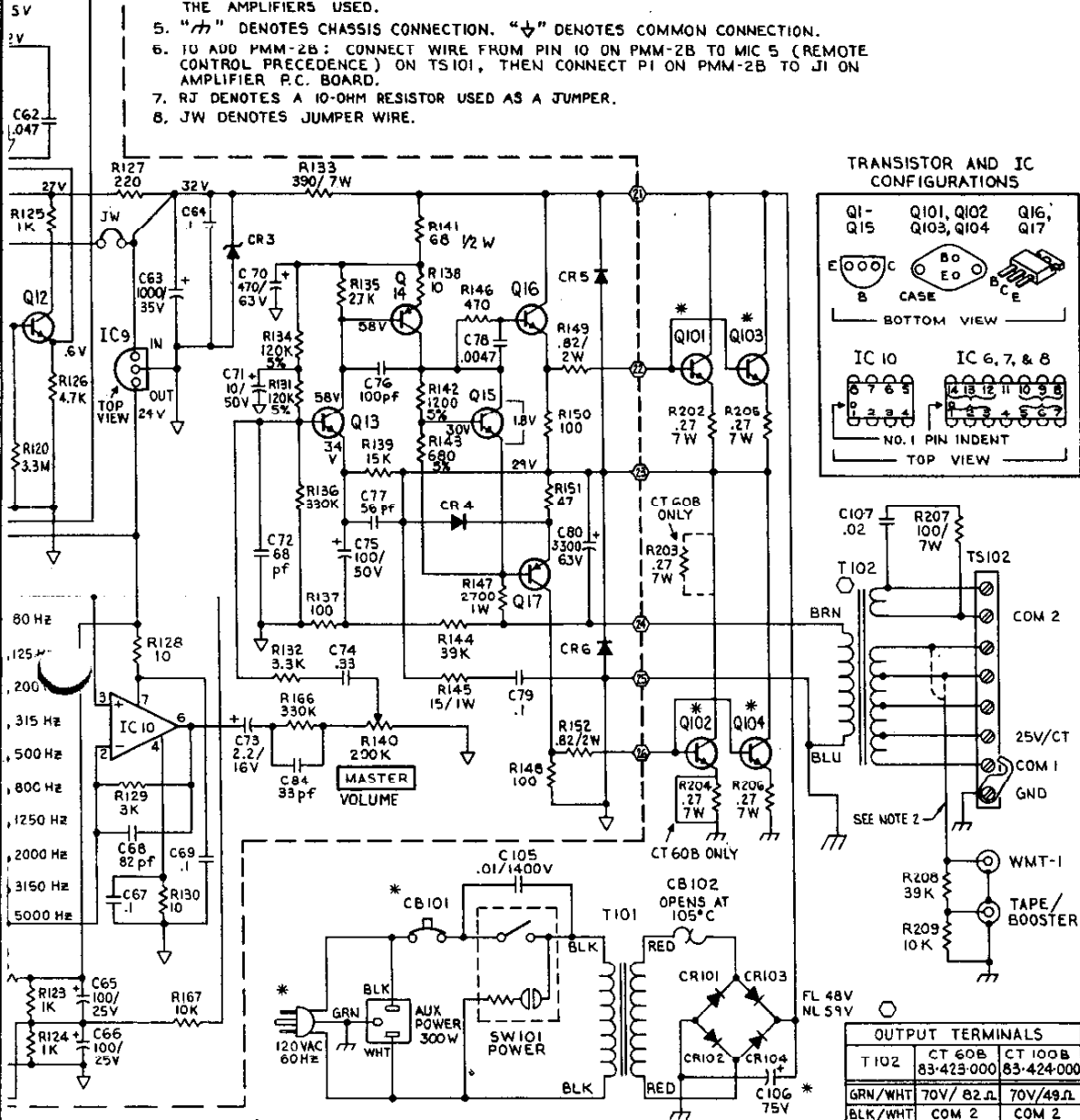


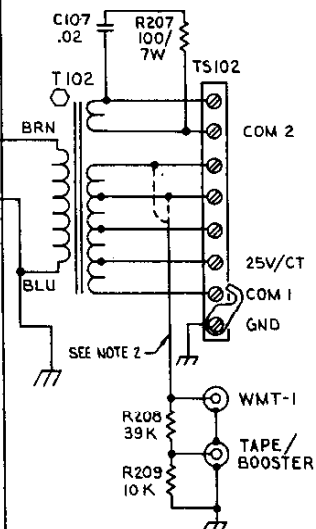
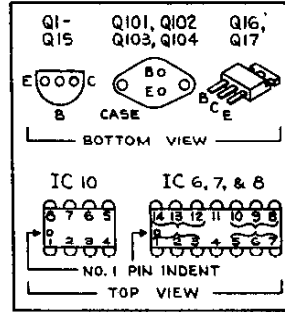
Figure 6—Schematic Diagram

NOTES:

1. UNLESS OTHERWISE SPECIFIED: ALL RESISTORS ARE 1/4 WATT $\pm 10\%$. CAPACITORS ARE IN MFD. VOLTAGES ARE DC $\pm 20\%$ MEASURED WITH A DVM.
2. WIRE CONNECTION TO ORANGE LEAD OF OUTPUT TRANSFORMER ON ALL AMPLIFIERS.
3. TO CONVERT ANY MIC INPUT(S) TO HI-Z: REMOVE JUMPERS BETWEEN PINS A & B, THEN DISCONNECT LEAD FROM PIN C AND CONNECT TO PIN A.
4. WHEN BRIDGING AMPLIFIERS, CONNECT BRIDGING GROUND BETWEEN THE AMPLIFIERS USED.
5. "C" DENOTES CHASSIS CONNECTION. "D" DENOTES COMMON CONNECTION.
6. TO ADD PMM-2B: CONNECT WIRE FROM PIN 10 ON PMM-2B TO MIC 5 (REMOTE CONTROL PRECEDENCE) ON TS101, THEN CONNECT P1 ON PMM-2B TO J1 ON AMPLIFIER P.C. BOARD.
7. RJ DENOTES A 10-OHM RESISTOR USED AS A JUMPER.
8. JW DENOTES JUMPER WIRE.



TRANSISTOR AND IC CONFIGURATIONS



OCTAVE	R	OHMS	R	OHMS	RB	CB	IC
R90	68K	R100	510 Ω				IC 6
R91	68K	R101	470 Ω	10 Ω			
R92	68K	R102	470 Ω				
R93	68K	R103	470 Ω				IC 7
R94	62K	R104	470 Ω	10 Ω			
R95	68K	R105	470 Ω				
R96	68K	R106	470 Ω				
R97	68K	R107	470 Ω				
R98	68K	R108	470 Ω	10 Ω			IC 8
R99		R109	510 Ω				

MODEL	POWER LINE CURRENT	CB101 HOLD CURRENT	T101	OUTPUT TRANSISTOR	C106
CT 60 B	1.6 A	1.6 A	83-809-000	Q101, Q102	2000
CT 100 B	2.5 A	2.5 A	83-814-000	Q101-Q104	3000

OUTPUT TERMINALS		
T102	CT 60B 83-423-000	CT 100B 83-424-000
GRN/WHT	70V/ 82 Ω	70V/49 Ω
BLK/WHT	COM 2	COM 2
ORN	25V/10.4 Ω	25V/6-8 Ω
GRN	10 Ω	10 Ω
YEL	8 Ω	—
BLK/ORN	25VCT/2.6 Ω	25VCT/1.56 Ω
BLK	COM 1	COM 1
BLK/YEL	—	4 Ω

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Models CT60B and CT100B

Ref. No.	Part No.	Description
<i>P. C. Board</i>		
—	45-7176-05	P. C. Board Assembly
C18,81-83	79-008-046	Cap., Elect., 22 μ F, 35V
C28,31	79-008-049	Cap., Elect., 500 μ F, 35V
C34,71	79-008-058	Cap., Elect., 10 μ F, 50V
C35	79-008-057	Cap., Elect., 50 μ F, 50V
C29,36,73	79-008-033	Cap., Elect., 2.2 μ F, 16V
C56	78-404-150	Cap., Dura Mica, 680pF
C61	79-120-005	Cap., Elect., Low Leakage, 2.2 μ F, 50V
C63	79-008-044	Cap., Elect., 1000 μ F, 35V
C65,66,75	79-008-062	Cap., Elect., 100 μ F, 50V
C70	79-119-001	Cap., Elect., 470 μ F, 63V
C80	79-119-015	Cap., Elect., 3300 μ F, 63V
CR1,2,4-6	96-5333-01	Diode, 400 prv @ 1A
CR3	96-5344-08	Zener Diode, 30V, 2W
IC1-5	96-5436-01	I. C., H11F3
IC6-8	96-5488-01	I. C., LM348N
IC9	96-5437-01	I. C., MC78L24CP
IC10	96-5489-01	I. C., LF356N
J1	85-1287-01	4-Point Header
Q1-10,12, 15	96-5213-01	Transistor, 2N5089/KSC945L
Q11	96-5176-01	Transistor, MPS6518/2N2907A
Q13	96-5298-01	Transistor, SPS1910/KSC945L
Q14	96-5283-01	Transistor, MPS-A55/KSC539Y
Q16	96-5357-01	Transistor, 2SD389P/2SD313E
Q17	96-5356-01	Transistor, 2SB512P/2SB507E
R53,55-57	77-001-830	Control, 1 megohm, audio taper
R111	77-007-003	Trimpot, 50kilohms
R140	77-001-812	Control, 200 kilohms, linear taper

Ref. No.	Part No.	Description
R149,152	76-107-096	Resistor, .82 ohms, 2W
T1-4	83-058-000	Mic Input Transformer
—	70-9313-01	Heat Sink Clip
<i>Chassis</i>		
C101-104	96-5241-01	Diode, 300 prv @ 3A
C106	79-509-052	Cap., Elect., 2000 μ F, 75V (CT60B)
	79-509-053	Cap., Elect., 3000 μ F, 75V (CT100B)
CB101	94-0023-05	Circuit Breaker, 1.6A (CT60B)
	94-0023-08	Circuit Breaker, 2.5A (CT100B)
CB102	94-0014-07	Thermal Breaker, 105°C
Q101,102	96-5385-01	Transistor, 2N3055H RCA, or
	96-5397-01	Transistor, 2N3055 Solitron (CT60B)
Q101-104	96-5385-01	Transistor, 2N3055H RCA, or
	96-5397-01	Transistor, 2N3055 Solitron (CT100B)
R201	77-001-825	Control, 2 megohms, linear taper
R202,203	76-116-003	Resistor, .27 ohms, 7W (CT60B)
R202, 204-206	76-116-003	Resistor, .27 ohms, 7W (CT100B)
R207	75-742-101	Resistor, 100 ohms, 7W
R80-89	77-001-826	Slide Control, 50 kilohms
SW101	81-009-035	Lighted Rocker Switch, 10A, SPST
T101	83-809-000	Power Transformer (CT60B)
	83-814-000	Power Transformer (CT100B)
T102	83-423-000	Output Transformer (CT60B)
	83-424-000	Output Transformer (CT100B)
—	14-9088-01	Foot
—	03-0676-01	Knob (0-10)
—	03-0677-01	Knob (5-0-5)
—	03-0628-04	Slide Control Knob
—	12-4231-01	Slide Control Cover